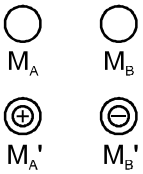
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE

NSEJS_STAGE-I (2016-17)

PAPER CODE : JS-530

HINTS & SOLUTIONS

1. When body charged negatively its mass will increase because it wil gain electrons & vice versa



M_A' is less than M_B'

Therefore $M_A' = M_A - M_O$

$M_B' = M_B + M_O$

M_o - mass of electron

2. $\sqrt{n+\sqrt{n+\sqrt{n}}}$ .....= x

$\sqrt{n+x} = x$

$x^2 - n - x = 0$

$x = \frac{1 \pm \sqrt{1+4n}}{2}$

$1 + \sqrt{1+4n}$ = 2, 4, 6, 8 .....

$\sqrt{1+4n}$ = 1, 3, 5, 7, ...

1 + 4n = 1, 9, 25, 49, ...

4n = 0, 8, 24, 48, 80 .....

n = 2, 6, 12, 20, 30

5 natural numbers are possible.

3.

A	B	C
x	x+1	x +2
Halogen	Noble gas	Alkali metal

A + Y $\rightarrow$ AY

Halogen Halogen

A & Y both belong to the same group so they posses eovalent bonding due to less difference in elctronegativity.

4. Composition of air = N_2 = 78%
O_2 = 21%
Ar = 1%

Mean molecular mass of air = $\frac{(78\times 28)+(21\times 32)+(1\times 40)}{100}$ = 28.96

density of one mole Air = $\frac{m}{v} = \frac{28.96}{22.4}$ = 1.29 = 1.3 g/L

5. Since the current flowing is same and area at P is more than area of Q.
Hence current per unit area near P is less than current per unit area near Q.

6. $\sqrt{n+\sqrt{n+\sqrt{n}}}$ .....= x (prime number)

$\sqrt{n+x}$ = x

$n + x = x^2$

$x^2 - x = n$

$x(x - 1) = n$

$n = 1 \times 2$

$= 2 \times 3$

$= 3 \times 4$

$= 4 \times 5$

$= 5 \times 6$

Only three cases are possible

$n = 1 \times 2 = 2$

$n = 2 \times 3 = 6$

$n = 4 \times 5 = 20$.

9. Heat is received by container B which will be transferred to A by convection hence liquid of B will boil first.

10. Number of squares = $4 \times 3 + 3 \times 2 + 2 \times 1$

$= 12 + 6 + 2 = 20$

11. $6MX + L_3(PO_4)_2 \rightarrow 2M_3PO_4 + 3LX_2$

given moles 0.5 0.2

$LR = \frac{\text{given moles}}{\text{stoichiometric coeff.}}$ $\frac{0.5}{6} < \frac{0.2}{1}$

MX is LR

So, 6 moles of MX produces 2 moles of M_3PO_4

$\therefore$ 0.5 moles will produces – $\frac{0.5 \times 2}{6}$

= 0.16 moles of M_3PO_4

12. For p

$1m^3$ contain $\rightarrow$ 16.3 mL

$\rightarrow 16.3 \times 10^{-6} m^3$

for y

1 ppb contain $\rightarrow 16.3\ m^3$

$1m^3$ contain $\rightarrow 16.3 \times 10^{-9} m^3$

for z

1 ppm contain $\rightarrow 16.3\ m^3$

$1m^3$ contain $\rightarrow 16.3 \times 10^{-6} m^3$

So y is least polluted and I will live in y.

13. Since acceleration due to gravity is always in the downward direction so both during ascent and decent acc. will be downward

14. $a^2 + b^2 - 8c = 3$ .....(1)

We know that perfect square of any positive integer is in the form of 4n or 4n + 1

Case - I : $a^2 = 4n_1$ and $b^2\ 4n_2$

then put in (1)

$4n_1 + 4n_2 - 8c = 3$

when we divide LHS by 4

we get rem = 0

but on RHS we get rem = 3

LHS $\neq$ RHS.

Case - II : If $a^2 = 4n_1 + 1$ and $b = 4n_2$

then, again put in equation (1)

$4n_1 + 1 + 4n_2 - 8c = 3$

Divide the above equation by 4.

On LHS, we will get rem. 1 but on RHS, we wll get 3.

$\therefore$ LHS $\neq$ RHS.

Case- III : If $a^2 = 4n_1 + 1$ and $b^2 = 4n_2 + 1$

then put in equation (1)

$4n_1 + 4n_2 + 1 - 8c = 3$

divide by 4.

On LHS, we will get rem = 2

On RHS, we will get rem = 3

$\therefore$ LHS $\neq$ RHS

Hence there are no possible value of a, b, c.

17. As the particle is going from O to A its velocity increases

$\therefore$ acc. is positive

Now from A its velocity starts decreasing so acc. is negative

therefore F_1 and F_2 are in opposite direction.

18. Number of elements in power set of x = $2^3 = 8$. Number of elements in the power set of power set of x is 2^8.

19. Heat of neutralisation depeds upon the degree of dissociation of acid.

As the dissociation decreases conc. of H^+ ions less a result lesser the value of heat of neutralisation

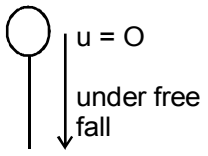
HCN < H_2S < CH_3COOH < HCOOH

–2.8 kJ – 3.34 kJ –55.2 kJ – 56.07 kJ

20. Lithium is haivng tendency to form Lithium nitride so N_2 should not be used

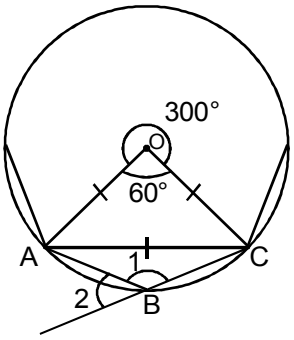
$6Li + N_2 \longrightarrow 2Li_3N$

21.



Since the system is there in free fall therefore there will be not tension in the string as there is no normal acting on the block.

22.



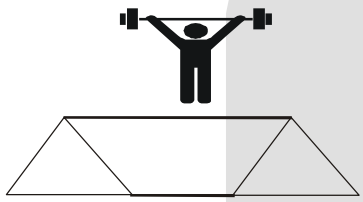
$\angle 1 = \frac{1}{2} \times 300° = 150°$

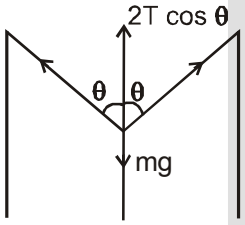
$\angle 2 = 180° - \angle 1 = 30°$

Number of side in a polygon = $\frac{360°}{30°}$ = 12.

$\therefore$ only one value of n is possible i.e., n = 12.

25.





$2T \cos\theta = W$

$T = \frac{w}{2\cos\theta}$

$\cos\theta$ will be between 0 to 1

so T = between w/2 and ∞

26. $\frac{n^2+1}{n+1} = n - 1 + \frac{2}{n+1}$

so n + 1 divides 2

$\therefore$ $n + 1 = \pm 1, \pm 2$

$\therefore$ $n = 0, 1, -2, -3.$

$\therefore$ four values of n are possible.

27.

$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$

2 moles 3 moles

$\frac{x}{27}$ $\left(\frac{3}{2}\right)\left(\frac{x}{23}\right)$ moles

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

1 mole 1 mole

$\frac{1-x}{65}$ $\left(\frac{1-x}{65}\right)$

(moles of H_2 from Al) + (moles of H_2 from Zn) = Total H_2 produces

$$\frac{3}{2}\frac{x}{27} + \frac{1-x}{65} = \frac{524}{22400}$$

$$\frac{x}{16} + \frac{1-x}{65} = 27.36$$

$x = 0.199 \text{ gm} \approx 0.2 \text{ gm}$

mass of Al = x = 0.2 gm

mass of Zn = 1 – x = 1 – 0.2 = 0.8 gm\

28. Carbon, nitrogen and phosphorous are non metals and silicon is metalloid

29. When object is placed between pole and focus its image is virtual and erect and enlarged therefore (A) is the correct Answer.

30. For No. x & y

$GM \geq HM$

$$\sqrt{xy} \geq \frac{2}{\frac{1}{x}+\frac{1}{y}}$$

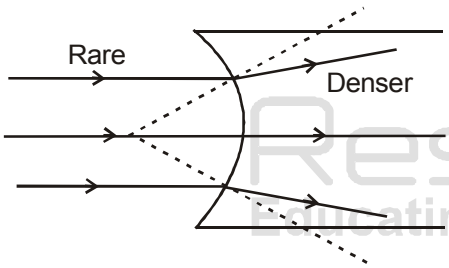
$$\sqrt{xy} \geq \frac{2}{2}$$

$$\sqrt{xy} \geq 1$$

$xy \geq 1$

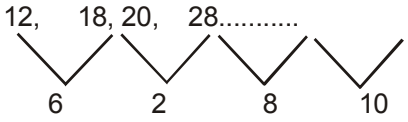
minimum value of xy is 1

33.

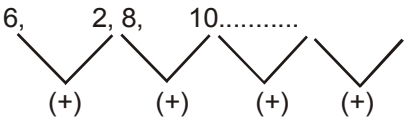


As ray of light goes from rare to denser it bend towards the normal. Therefore B is the correct answer.

34.

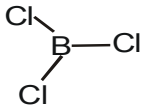


By observing the above pattern, we can say that the difference between 2 terms are



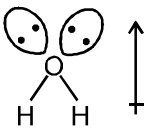
So, the next difference is equal to the sum of the previous 2 differences.
By this we will get $T_{10} = 324$

35. BCl_3

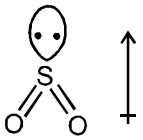


In BCl_3, Boron has only 6 electrons around it, so due to incomplete octet it act as Lewis acid.

36. Only 5 compounds will show permant dipole moment due to their lack of symmetry

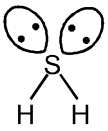


water contain two lone pairs.

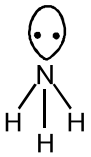


it contains one lone pair, unsymmetrical.

unsymmetrical



unsymmetrical



unsymmetrical

(Symmetrical molecules have zero dipole moment)

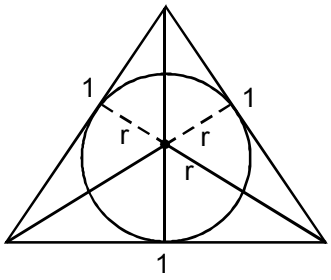
37. Area of triangle formed will be

$= \frac{1}{2} \times \text{Base} \times \text{height}$

$= \frac{1}{2} \times 4 \times 4$

$= 8\ cm^2$

38.



ar. of $\Delta = \frac{\sqrt{3}}{4} \times (1)^2 = \frac{\sqrt{3}}{4}$

area of circle = πr^2

$= \frac{\pi}{4\times 3} = \frac{\pi}{12} \left\{r = \frac{1}{2\sqrt{3}}\right\}$

area of Δ – area of circle

$= \frac{\sqrt{3}}{4} - \frac{\pi}{12}$

P(lying outside the incircle) = $\frac{\text{Area of } \Delta - \text{ar. of circle}}{\text{ar. of } \Delta}$

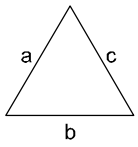
$$= \frac{\frac{\sqrt{3}}{4} - \frac{\pi}{12}}{\frac{\sqrt{3}}{4}}$$

$= 1 - \frac{\pi}{12} \times \frac{4}{\sqrt{3}}$

$= 1 - \frac{\pi}{3\sqrt{3}}$

41. When the object is in rarer medium and is viewed from a denser medium then the obj. will appear to be at more height then its actual. h' > h

42.



a + b + c = 316 = 2s

ar $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

we know that for the given sum the product will be maximum when the terms are equal.
as s is fixed
$\therefore$ s – a = s – b = s – c is possible when a = b = c.
as a, b, c are integer
$\therefore$ we try to divide into equal part which one near to each other.
So only 1 such Δ is possible with sides.
$\therefore$ a = b = 105, c = 106.

43. Floor have phosphorous which reacts with old urine to releases phosphorous which ignite when oxidises. Phosphorous literally means "light-bearer", as the first compound of the element glowed in the dark moreover, its also a major element present in urine.

44. $KOH + NH_4Cl \rightarrow KCl + NH_3 + H_2O$

45. Spring balance shows tension and weighing machine shows normal
$T = mg - B$
$T = W_1 = W_A - B \rightarrow$ for spring
$N = W_2 = W_B + B. \rightarrow$ for weighing machine

46. $6 \rightarrow 2 \times 3 \Rightarrow$ 4 divisors.
$8 \rightarrow (2)^3$
$10 \rightarrow 5\times 2$
$14 \rightarrow 7\times 2$
$15 \rightarrow 5\times 3$
$21 \rightarrow 7\times 3$
$22 \rightarrow 11\times 2$
$26 \rightarrow 13\times 2$
$27 \rightarrow 3^3$
$33 \rightarrow 11\times 3$
$34 \rightarrow 17\times 2$
$35 \rightarrow 7\times 5$
$38 \rightarrow 19\times 2$
$39 \rightarrow 13\times 3$
Total number = 14

49. $u = -6$ cm
$f_1 = ?$
$v = \infty$
So $f_1 = -6$ cm
in second case
$u = -6$ cm
$v = (30-6)$
$= 24$ cm

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{24} - \frac{1}{6}$$

$$= \frac{-1}{8}$$

$f_2 = -8$

$$\frac{f_1}{f_2} = \frac{6}{8} = \frac{3}{4}$$

50. $N = 3^8 (3^{10} + 6^5) + 2^3 (2^{12} + 6^7)$
$= 3^{18} + 3^{13} \times 2^5 + 2^{15} + 2^{10} 3^7$
$= (3^6)^3 + (2^5)^3 + 3. (3^6)^2 (2^5) + 3 (3^6) (2^5)^2$
$= (3^6 + 2^5)^3$
$= (761)^3$
As 761 in not a perfect square so. N is not a perfect square but it is a perfect cube of 761.

51. Melting point is the temperature at which solid and liquid state.

52. n-butane $CH_3 - CH_2 - CH_2 - CH_3$

iso-butane $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

n - butanol $CH_3 - CH_2 - CH_2 - CH_2 - OH$

iso-butanol $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - OH$

The strongest intermolecular force that is happening in this molecule is hydrogen bonding. The iso-butanol group, will do a better job of blocking off one side of the –OH group, making it a little bit harder to make a hydrogen bond the net result being the iso-butanol has lower boiling point than n-butanol.

53. Pressure at same height inside the same liquid remains same so that

$10 \times 3.36 \times g = 2 \times 13.6 \times g + 8 \times \rho_x \times g$

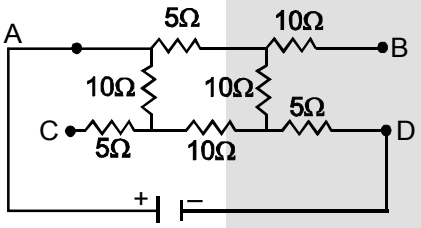
$\rho_x = 0.8$ g/c.c

54. $n = {}^6C_2 \times {}^4C_2 = \frac{6\times5}{2} \times \frac{4\times3}{2} = 90$

$m = {}^5C_2 \times {}^5C_2 = \frac{5\times4}{2} \times \frac{5\times4}{2} = 100.$

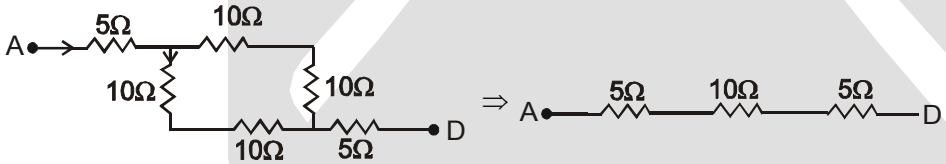
$\therefore$ m > n or m > n + 5.

57.



Now since the battery is connected between A & D

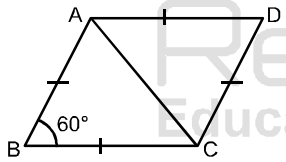
$\therefore$ C and B becomes open terminal



Req = 5 + 10 + 5

= 20 Ω

58. As one angle of rhombus is 60°



$\therefore$ Rhombus is divided into two eq. Δ.

Rhombus Area = $2 \times \frac{\sqrt{3}}{4} AB^2 = \frac{\sqrt{3}}{2} AB^2$.

59. $CO_2 + H_2O \rightarrow H_2CO_3$ (hydration)

$CH_3 - CH_2 - OH \xrightarrow{CrO_3} CH_3 - CHO$ (oxidation)

$CH_3 - CHO \xrightarrow[LiAlH_4]{} CH_3 - CH_2 - OH$ (Reduction)

$H_2SO_4 \rightarrow SO_3 + H_2O$ (dehydration)

60. Atomic number of ruthenium is 44 which is present just below iron (Fe).

61. Current across B_3 is maximum and current in B_1 and B_2 is same although < B_3 and resistance of B_2 is more than B_1 so by relation of I^2R

$w_1 < w_2 < w_3$

62. a, b > 0

Am $\geq$ GM

$$\frac{a+b}{2} \geq \sqrt{ab}$$

$$a + b \geq 2\sqrt{ab}$$

$$a + b > \sqrt{ab}$$

65. (A) $V_{AB} : V_{BC} = R_{AB} : R_{BC}$ (in series $V \propto R$)

$$= \frac{\ell L}{\pi(\ell r)^2} : \frac{\ell L}{\pi(r)^2}$$

$$\frac{V_{AB}}{V_{BC}} = 4 : 1$$

$$\frac{V_{AB}}{V_{BC}} = \frac{4}{1}$$

$V_{AB} = 4V_{BC}$

66. a is not less than 4 means a is either equal to 4 or greater than 4 which can be writtern

$a \geq 4$

67. chemist $d_A = 2$, $d_B = 3$

40% vol. of A, 60% vol. of B

Density off mixture = $\frac{0.8v + 1.8v}{v} = \frac{2.6v}{v} = 2.6$

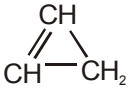
Now as per law of floatation $\rho vg = 2.6\ vg$

$\rho = 2.6$ g/ml

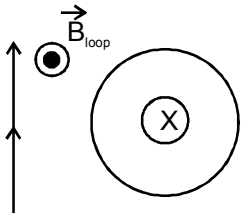
68. Three

C_3H_4

$H_2C = C = CH_2$, $HC \equiv C - CH_3$



69.



Now ∴ magnetic field due to loop is outward
∴ By flemmings left hand rule or right hand palm rule force on the current carrying conductor will be towards loop

70. Buildings of 'A' and 'B' can be on same side of the car and on the opposite sides of the car. In both the cases, we cannot compare their height.

73. Magnification = $\frac{f}{f-u}$

$m = \frac{1}{n} = \frac{f}{f-u}$

$f - u = nf$

$f - nf = u$

$f(1-n) = u$

$\because$ u is –ve

$\therefore u = f(n-1)$

74. Total surface area

$= 4\pi (\sqrt{2}+\sqrt{3})^2$ cm^2

$(\sqrt{2}+\sqrt{3})^2 = 5 + 2\sqrt{6}$

Area = $400\pi (5+ 2\sqrt{6})$ mm^2

75. Silver is the metallic element with the atomic number 47. Its symbol is Ag, from the latin argentum. Argentina is derived from Argentum. Another key use for silver is in the millions of water purifiers. Silver prevents bacteria and algoe from building up in the filters.

76. Valence electron of NO_3^- is $\rightarrow 24$ and valence e^- in $CO_3^{-2} \rightarrow 24$
$HCO_3^- \rightarrow 24$
$NF_3 \rightarrow 26$.
and $SO_3 \rightarrow 24$
So NF_3 contain 26 valence electron and other contain 24.

77. 2 : 10 am

angle = $2 \times 30 - 10 \times \frac{11}{2}$

$= 60 - 55$
$= 5°$

78. Volume of cylinder = volume of sphere

$\pi r^2 h = \frac{4}{3}\pi R^3$

$\pi (3)^2 \times 6 = \frac{4}{3} \times \pi R^3$

$R = 3\sqrt[3]{\frac{3}{2}}$